Aerial Vehicles (Air Taxis And Jet-Powered Humans): Finding A Legal Regime

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Abstract

Rapid advancements in aerial mobility (particularly air taxis with VTOL systems and jet-powered devices enabling individual human flight) pose regulatory challenges beyond the capacity of existing international and national aviation laws. Their divergence from conventional aircraft creates uncertainty in legal classification under the Chicago Convention, ICAO standards, and domestic air navigation rules. This study aims to identify legal gaps and examine the need for an appropriate legal regime governing emerging aerial mobility technologies. This research employs a normative and analytical approach, reviewing international aviation frameworks, domestic regulations, and national initiatives related to air taxis, jet-powered flight, and advanced air mobility governance. The study finds that current regulatory models remain fragmented and insufficient to govern air taxis and jet-powered human flight. Despite limited experimentation in some jurisdictions, no harmonized or comprehensive legal framework exists to address safety, liability, airspace integration, and classification challenges. The findings highlight the need for a flexible, risk-based, and internationally coordinated legal framework for emerging aerial mobility technologies. Such a framework can support safer integration into urban airspace and promote responsible innovation in future transportation systems.

Keywords: advanced air mobility; aerial vehicle; air taxis; jet-powered human; VTOL.

1. Introduction

The development of aerial mobility technology in the last decade has advanced far beyond conventional aviation models that formed the basis of international aviation law. The emergence of new aerial vehicles, particularly air taxis using vertical take-off and landing (VTOL)[1] systems as part of Advanced Air Mobility (AAM)[2], as well as jet-powered devices enabling individual human flight, has created an entirely different landscape from the configurations of fixed-wing

[1] Paola Di Mascio et al., "Vertiports: The Infrastructure Backbone of Advanced Air Mobility—A Review," *Eng* 6, no. 5 (2025): 93, https://doi.org/10.3390/eng6050093.
[2] Mirjam Wiedemann et al., "Advanced Air Mobility: A Comparative Review of Policies from around the World—Lessons for Australia," *Transportation Research Interdisciplinary Perspectives* 24 (March 2024): 100988, https://doi.org/10.1016/j.trip.2023.100988.

aircraft[3] and helicopters[4] envisioned when the 1944 Chicago Convention was drafted. This transformation raises new issues concerning the definition of aircraft[5], safety standards, operator liability, and the structure of airspace management in low-altitude environments[6].

Although several states and aviation authorities have begun developing regulatory frameworks for VTOL vehicles, these developments remain partial and do not comprehensively address the complexities of new technologies[7]. Air taxis possess unique characteristics (electric propulsion, limited payload capacity, autonomous or semi-autonomous operation, and integration into dense urban airspace)[8] that do not directly align with the aircraft categories described in ICAO Annexes. Meanwhile, jet-powered devices mounted directly onto the human body (jet-powered human flight) are even more difficult to classify, as they exist on the boundary between vehicles, mobility aids, and personal propulsion systems. No international standard explains how such devices should be certified, who qualifies as an operator, or how operational risks in low-altitude airspace should be regulated.

The complexity increases when both technologies are projected to operate in the same airspace as Unmanned Aircraft Systems (UAS), which are already regulated in several jurisdictions. The interaction between manned aviation, hybrid flight operations, and UAS requires a new traffic management system combining Air Traffic Management (ATM) with Unmanned Traffic Management (UTM). However, neither ICAO nor many states have provided normative models that clearly articulate the interface between these systems. Debates continue regarding whether AAM should use dedicated navigation corridors, whether operations must be fully autopilot-based[9], and how law enforcement should be implemented in low-altitude zones, with no consensus reached.

The shift from traditional pilot-operated models to increasingly automated configurations creates liability structures that diverge from conventional airline responsibility regimes. States tend to position operators as the primary bearers of accident risk. However, applying this concept to AAM produces inconsistencies because AAM distributes safety functions among automated

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[3] Chananya Charnsethikul et al., "Urban Air Mobility Aircraft Operations in Urban Environments: A Review of Potential Safety Risks," *Aerospace* 12, no. 4 (2025): 306, https://doi.org/10.3390/aerospace12040306.

[4] Tapdig Imanov, "Modification of the Regulatory Framework for Aircraft with E-VTOL Capabilities," *International Journal of Aviation Science and Technology* 6, no. 2 (2025): 64–78, https://doi.org/10.23890/IJAST.vm06is02.0201.

[5] Ruwantissa Abeyratne, "Current Legal Problems in Interpreting International Civil Aviation Law," *Frontiers in Law* 2 (July 2023): 57–71, https://doi.org/10.6000/2817-2302.2023.02.08.

[6] Yuran Shi, "Aviation Safety for Urban Air Mobility: Pilot Licensing and Fatigue Management," *Journal of Intelligent & Robotic Systems* 110, no. 1 (2024): 35, https://doi.org/10.1007/s10846-024-02070-x.

[7] Panagiotis Aposporis, "A Review of Global and Regional Frameworks for the Integration of an Unmanned Aircraft System in Air Traffic Management," *Transportation Research Interdisciplinary Perspectives* 24 (March 2024): 101064, https://doi.org/10.1016/j.trip.2024.101064.

[8] Karolin Schweiger and Lukas Preis, "Urban Air Mobility: Systematic Review of Scientific Publications and Regulations for Vertiport Design and Operations," *Drones* 6, no. 7 (2022): 179, https://doi.org/10.3390/drones6070179.

[9] Aposporis, "A Review of Global and Regional Frameworks for the Integration of an Unmanned Aircraft System in Air Traffic Management."

systems, navigation data providers, service operators, and software manufacturers. Legal scholarship argues that the traditional liability model centered on the pilot in command is no longer adequate, especially for autonomous air taxis. Moreover, jet-powered human flight poses an additional challenge, as individuals are simultaneously users and "vehicles," raising questions about whether they fall under airworthiness regimes or are merely using personal devices.

These conditions indicate the existence of a regulatory vacuum in the current aviation law framework, where technological development progresses far more rapidly than legal rulemaking. Even existing international air law instruments are not fully prepared to address the operational characteristics of AAM and may require revision. Therefore, this study is important to identify existing limitations and formulate new legal principles suitable for emerging aerial mobility. The aim of this research is to examine regulatory gaps arising in the operation of VTOL air taxis and jet-powered devices for individual human flight. The study focuses on issues of classification, safety certification, operator liability, urban airspace management, privacy implications, and compatibility between manned aviation and UTM systems. It assesses the applicability of existing regulations and explores how new legal models may be developed to align technological progress with public safety and interest.

Several studies highlight that advanced air mobility (AAM) has grown across multiple disciplines, particularly concerning vehicle technology, operational safety, and airspace integration. Research by Wiedemann[10] emphasizes that the development of VTOL and eVTOL is shaped by electrification, automation, and emerging urban transportation needs. Schweiger and Preis[11] show that "vertiport" has become a standard term in 80% of relevant scientific publications, while also identifying fragmented research on vertiport design, capacity, and operations worldwide. Similarly, Di Mascio[12] describes vertiports as the "backbone" of AAM and stresses that successful AAM adoption depends on the readiness of this infrastructure, including multimodal integration, safety standards, and evolving TLOF/FATO design guidelines aligned with FAA and EASA requirements.

From the regulatory perspective, several studies emphasize that current international legal frameworks are unable to accommodate new forms of aerial vehicles. Aposporis[13] highlights a global review of UAS regulatory frameworks and finds that integration of unmanned systems into national airspace remains constrained by definitional inconsistency, divergent certification procedures, and the absence of international low-altitude operational standards, all of which directly affect the readiness of AAM for large-scale commercial operations.

[10] Wiedemann et al., "Advanced Air Mobility."
[11] Schweiger and Preis, "Urban Air Mobility."
[12] Di Mascio et al., "Vertiports."
[13] Aposporis, "A Review of Global and Regional Frameworks for the Integration of an Unmanned Aircraft System in Air Traffic Management."

Despite technical, safety, and integration-focused studies, a significant research gap remains. Almost no studies specifically address the legal regime governing jet-powered human flight, nor is there a comprehensive legal framework for regulating the combination of VTOL air taxis and individual jet propulsion devices. Thus, this research occupies a clear position in the literature by filling a normative gap in air law concerning new forms of personal aerial mobility that remain unclassified.

2. Method

This research used the doctrinal method of legal research. This study concentrates on doctrines which are syntheses of rules, principles, norms, or interpretative guidelines and values, and proceeds with both locating the sources of law and interpreting or analysing the text.[14] Normatively, this research includes the study of legal principles, legal systematic structure, and the degree of legal synchronization,[15] using both a conceptual and statutory approach[16]. Doctrinal research involves rigorous analysis and creative synthesis, the making of connection between seemingly disparate doctrinal strands, and the challenge of extracting general principles from an inchoate mass of primary materials. It makes a unique blend of deduction and induction so that conceptual analysis of law and creative synthesis together build up the legal proposition which engages in theoretical discussion.[17]

3. Results and Discussion

3.1. Classification of New Aerial Vehicles

VTOL-based air taxis and jet-powered human devices emerge within the evolution of advanced aerial mobility (AAM) that was never anticipated by classical aviation law. The Chicago Convention of 1944 defines an aircraft as any machine deriving support in the air, but this abstract definition was formulated in an era without personal aerial vehicles, micro-propulsion systems, or intensive low-altitude urban operations. Modern UAM ecosystems described in recent research include electric propulsion, multiple small rotors, high levels of automation, and operational patterns that differ substantially from conventional aircraft. This produces a

[14] B. C. Nirmal and Rajnish Kumar Singh, *Contemporary Issues in International Law: Environment, International Trade, Information Technology and Legal Education* (Springer, 2018); P. Ishwara Bhat, *Idea and Methods of Legal Research* (Oxford University Press, 2019), 28.
[15] Soerjono Soekanto, *Pengantar penelitian hukum* (Penerbit Universitas Indonesia (UI-Press), 1986), 51; Soerjono Soekano and Sri Mamudji, *Penelitian Hukum Normatif: Suatu Tinjauan Singkat* (Rajawali, 1986), 15.
[16] Peter Mahmud Marzuki, *Penelitian Hukum: Edisi Revisi* (Prenada Media, 2014), 133.
[17] Terry Hutchinson, "Doctrinal Research: Researching the Jury," in *Reserach Methods in Law*, 2nd ed. (Routledge, 2013), 7–8; Dennis Pearce et al., *Australian Law Schools: A Discipline Assessment for the Commonwealth Tertiary Education Commission* (Australian Government Publishing Service, 1987), 6; P. Ishwara Bhat, *Idea and Methods of Legal Research*, 29.

conceptual mismatch between existing legal categories and new technological characteristics[18]. Authorities such as the FAA classify many eVTOLs as powered-lift, while EASA has developed the Special Condition VTOL for crewed vertical vehicles. However, neither approach is universal nor harmonized internationally through ICAO. As a result, global classification remains fragmented, where a vehicle may be recognized as a certified VTOL in one country but fall into a legal grey area in another.

Even greater uncertainty applies to jet-powered human devices. Jet suits have no independent aircraft structure, no registration number, and no airworthiness category under ICAO Annex 7. They utilize micro-propulsion systems attached to the human body, blurring the boundary between "operator" and "vehicle." Because they fit neither manned aircraft nor drone categories, jet suits fall outside formal aviation frameworks entirely. There is no basis for technical classification, registration, or the application of air navigation rules. Thus, normatively, these devices exist in an even broader regulatory vacuum than eVTOLs. The absence of clear categorization affects not merely terminology but the applicability of all aviation law instruments: certification, licensing, airworthiness, operator status, ATS rules, and liability regimes. As long as definitional frameworks remain outdated, downstream regulation continues to operate under uncertainty.

3.2. Fragmentation of Aviation Safety Certification

3.2.1. Airworthiness Certification for VTOL

The development of vertical aircraft and jet-propelled human devices occurs within an aviation legal framework unprepared for new forms of aerial mobility. Existing safety certification categories were designed for conventional aircraft, whereas eVTOLs and jet devices exhibit technical characteristics that deviate from ICAO and national assumptions. Annex 8 ICAO provides the general foundation for airworthiness, but it does not explicitly accommodate multi-rotor, electric, or hybrid-electric crewed VTOL configurations. Research on UAM integration shows that states apply different regulatory approaches, resulting in non-uniform safety standards. eVTOL systems depend heavily on system redundancy, electrical power distribution, and automated control, which do not fully align with traditional airworthiness standards.

EASA has taken a progressive approach through its Special Condition for VTOL (SC-VTOL) issued in 2019, introducing two risk categories (Basic and Enhanced). The FAA follows a different path by placing many eVTOLs under the powered-lift category, requiring adaptations from Parts 23/27/29 but without forming a dedicated category. The divergence between EASA and FAA results in substantial differences in certification bases, hindering international harmonization. Consequently, a common safety baseline for commercial VTOL operations does not yet exist.

[18] L. M. Cardone et al., "Review of the Recent Developments About the Hybrid Propelled Aircraft," *Aerotecnica Missili & Spazio* 103, no. 1 (2024): 17–37, https://doi.org/10.1007/s42496-023-00173-6.

Countries in Asia such as Japan and Singapore still use case-by-case assessments, indicating a lack of global consensus.

3.2.2. Absence of a Certification Regime for Jet-Powered Human Flight

Jet-powered devices mounted directly onto the human body pose the most significant regulatory challenge. Technically, a jetpack is not a conventional aircraft; operationally, it is not a drone; legally, no category explicitly encompasses personal propulsion devices. The risk profile is extremely high, depending on human body stability, limited fuel capacity, and the absence of system redundancy.

No aviation authority has formally issued certification bases for jetpacks. The FAA manages them only through limited demonstration COAs; EASA treats some devices as experimental aircraft; many jurisdictions do not classify them at all. A recent study in the *Journal of Air Transport Management* notes that regulatory gaps in jet-powered human flight enable "unregulated high-risk low-altitude operations," especially in urban areas. The absence of certification standards has direct public safety implications: no minimum technical standards, no reliability verification, and no design requirements to protect operators or third parties.

3.2.3. Operator Obligations and Liability

Certification fragmentation directly affects liability regimes. In crewed VTOLs, the roles of pilot and operator remain relatively clear. In jet-powered human flight, however, the pilot effectively forms part of the propulsion system, creating a "merged liability position." This makes it difficult to fit within conventional strict liability or fault-based frameworks.

eVTOL manufacturers bear greater product-based risks due to the use of electric systems, control software, and partial autonomy, all of which can fail at multiple levels. Jetpack manufacturers, typically producing devices at small scale without formal certification, often fall outside standard product liability regimes applicable to aircraft and helicopters. In this context, the operator (who is also the pilot) bears nearly all risk, while no specific liability standards apply.

The findings above indicate that the existing aviation law regime is not yet capable of accommodating new forms of aerial mobility. First, there is no international consensus regarding the classification of VTOL or jet-powered human flight, and this definitional uncertainty has direct implications for registration, airworthiness, pilot licensing, and operational standards. Second, there is global fragmentation in certification approaches, with EASA being relatively progressive through SC-VTOL, while the FAA uses the powered-lift category without an independent categorical basis, and many Asian countries continue to adopt ad hoc approaches. Third, the absence of a certification framework for individual jet devices reflects an even more extreme regulatory vacuum compared to VTOL. These technologies operate without minimum technical standards, verification processes, or airworthiness obligations. Fourth, the distribution of safety functions in AAM, which relies heavily on automated systems, shifts the structure of legal responsibility from the pilot to operators, software manufacturers, and navigation data providers. This represents a fundamental misalignment with the liability regime governing conventional aircraft. Finally, the integration of AAM with UTM and ATM still lacks a clear normative framework, particularly for low-altitude operations in densely populated urban areas. These findings indicate an urgent need for international air law reform that is risk-based and adaptive approach.

4. Conclusion

This research confirms that emerging aerial mobility particularly VTOL air taxis and jet-powered human flight operates within a legal regime structurally unprepared for their technical and operational characteristics. Inconsistent legal classification, the absence of harmonized safety certification, and unclear liability structures show that international aviation law has fallen behind technological innovation. Fragmented national regulation especially among the FAA, EASA, and Asian jurisdictions further illustrates the absence of global standards for safety and legal certainty. A flexible, risk-based, internationally coordinated legal regime is therefore necessary to accommodate AAM complexities. Such a framework must include clear definitions and classifications, airworthiness standards for electric and micro-propulsion vehicles, restructured liability models, and integrated low-altitude airspace governance between ATM and UTM. International aviation law reform is essential to ensure that aerial mobility innovations advance safely, responsibly, and in alignment with public interest.

5. Recommendations

1. ICAO should develop new categories within Annex 7 and Annex 8 for crewed VTOLs and individual jet-powered devices, including definitions, registration structures, and airworthiness parameters.
2. Implement risk-based certification for eVTOLs and jet-powered human flight, with standards on power systems, stability, sensor redundancy, and autonomous resilience.
3. Reform liability models to allocate responsibility among pilots/operators, hardware manufacturers, software developers, and data providers.
4. Develop low-altitude airspace governance models clarifying UAM corridors, route priorities, ATM–UTM interfaces, and enforcement mechanisms.
5. Adopt privacy and data-protection safeguards tailored to sensor-equipped AAM vehicles operating in urban environments.

6. References

Abeyratne, Ruwantissa. "Current Legal Problems in Interpreting International Civil Aviation Law." *Frontiers in Law* 2 (July 2023): 57–71. https://doi.org/10.6000/2817-2302.2023.02.08.

Aposporis, Panagiotis. "A Review of Global and Regional Frameworks for the Integration of an Unmanned Aircraft System in Air Traffic Management." *Transportation Research Interdisciplinary Perspectives* 24 (March 2024): 101064. https://doi.org/10.1016/j.trip.2024.101064.

Cardone, L. M., G. Petrone, S. De Rosa, F. Franco, and C. S. Greco. "Review of the Recent Developments About the Hybrid Propelled Aircraft." *Aerotecnica Missili & Spazio* 103, no. 1 (2024): 17–37. https://doi.org/10.1007/s42496-023-00173-6.

Charnsethikul, Chananya, Jose M. Silva, Wim J. C. Verhagen, and Raj Das. "Urban Air Mobility Aircraft Operations in Urban Environments: A Review of Potential Safety Risks." *Aerospace* 12, no. 4 (2025): 306. https://doi.org/10.3390/aerospace12040306.

Dennis Pearce, Enid Campbell, and Don Harding. *Australian Law Schools: A Discipline Assessment for the Commonwealth Tertiary Education Commission*. Australian Government Publishing Service, 1987.

Di Mascio, Paola, Giulia Del Serrone, and Laura Moretti. "Vertiports: The Infrastructure Backbone of Advanced Air Mobility—A Review." *Eng* 6, no. 5 (2025): 93. https://doi.org/10.3390/eng6050093.

Imanov, Tapdig. "Modification of the Regulatory Framework for Aircraft with E-VTOL Capabilities." *International Journal of Aviation Science and Technology* 6, no. 2 (2025): 64–78. https://doi.org/10.23890/IJAST.vm06is02.0201.

Nirmal, B. C., and Rajnish Kumar Singh. *Contemporary Issues in International Law: Environment, International Trade, Information Technology and Legal Education*. Springer, 2018.

P. Ishwara Bhat. *Idea and Methods of Legal Research*. Oxford University Press, 2019.

Peter Mahmud Marzuki. *Penelitian Hukum: Edisi Revisi*. Prenada Media, 2014.

Schweiger, Karolin, and Lukas Preis. "Urban Air Mobility: Systematic Review of Scientific Publications and Regulations for Vertiport Design and Operations." *Drones* 6, no. 7 (2022): 179. https://doi.org/10.3390/drones6070179.

Shi, Yuran. "Aviation Safety for Urban Air Mobility: Pilot Licensing and Fatigue Management." *Journal of Intelligent & Robotic Systems* 110, no. 1 (2024): 35. https://doi.org/10.1007/s10846-024-02070-x.

Soekanto, Soerjono. *Pengantar penelitian hukum*. Penerbit Universitas Indonesia (UI-Press), 1986.

Soerjono Soekano and Sri Mamudji. *Penelitian Hukum Normatif: Suatu Tinjauan Singkat*. Rajawali, 1986.

Terry Hutchinson. "Doctrinal Research: Researching the Jury." In *Reserach Methods in Law*, 2nd ed. Routledge, 2013.

Wiedemann, Mirjam, Man Liang, Ganesh Keremane, and Kate Quigley. "Advanced Air Mobility: A Comparative Review of Policies from around the World—Lessons for Australia." *Transportation Research Interdisciplinary Perspectives* 24 (March 2024): 100988. https://doi.org/10.1016/j.trip.2023.100988.